

DOCUMENT RESUME

ED 424 290

TM 029 173

AUTHOR Ediger, Marlow
TITLE Appraising Pupil Progress in Mathematics.
PUB DATE 1998-00-00
NOTE 16p.
PUB TYPE Reports - Descriptive (141)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Check Lists; Classroom Observation Techniques; Computer Assisted Testing; *Criterion Referenced Tests; *Diagnostic Tests; *Educational Assessment; Elementary Secondary Education; Evaluation Methods; *Mathematics Achievement; Mathematics Instruction; Norm Referenced Tests; *Portfolio Assessment; *Student Evaluation

ABSTRACT

A contemporary mathematics curriculum emphasizes using a variety of evaluation techniques to determine student achievement. Too frequently in the past, standardized norm-referenced tests and their results provided the main information related to student achievement. These tests have not presented objectives for teachers to use in teaching mathematics. In addition, norm-referenced tests spread student achievement out from low to high in terms of test results. Today, the emphasis is on evaluating students in terms of having achieved stated objectives in mathematics in ongoing lessons and units of study, rather than in making comparisons among learners. A variety of approaches are used to determine student achievement in mathematics today. Each of the following is described, and some examples are given of using each approach: (1) criterion-referenced tests; (2) teacher observation of a student's achievement in mathematics; (3) conferences with student; (4) parent and teacher conferences; (5) diagnostic testing and the results of such tests; (6) checklists and rating scales; (7) computer-managed evaluation; and (8) portfolio approaches to determining student achievement in mathematics. (Contains seven references.) (SLD)

* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *

Appraising Pupil Progress in Mathematics

Dr. Marlow Ediger

PERMISSION TO REPRODUCE AND
DISSEMINATE THIS MATERIAL HAS
BEEN GRANTED BY

Marlow Ediger

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)

1

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

☒ This document has been reproduced as
received from the person or organization
originating it.

☐ Minor changes have been made to
improve reproduction quality.

• Points of view or opinions stated in this
document do not necessarily represent
official OERI position or policy.

APPRAISING PUPIL PROGRESS IN MATHEMATICS

A good mathematics teacher is a proficient evaluator of pupil achievement in mathematics. A variety of procedures need to be used in the evaluation process. Why? One technique or approach to evaluation may measure diverse facets of growth as compared to another, such as an achievement test of pupil knowledge of mathematics versus teacher observation of learner attitudes. There are evaluation devices that emphasize a score or numerical result that a pupil has achieved, such as per cent correct, percentile rank, standard deviation results, stanine rankings, and quartile deviations. Other evaluation results do not stress numerical figures such as using teacher observation recorded in journal writing. The latter may stress valid results about how well a pupil is doing in mathematics. However, two teachers observing the same pupil may not come up with the same results due to diverse perceptions. Even if a teacher attempts to measure pupil achievement in mathematics whereby a numerical result would be in the offing, it is good procedure to check one approach against another. A specific numerical result may not be a good indicator of pupil achievement since it is a one shot case to ascertain pupil progress in mathematics. The teacher needs to be careful that too much time is not given to testing and measuring. Adequate time for instruction is a must! Quality objectives need to be in the offing in any lesson or unit of study so that each pupil may achieve as optimally as possible. Evaluation is stressed further in terms of appraising the quality of objectives, of instructional activities, and the evaluation techniques themselves (Ediger, 1997).

Behaviorally Stated Objectives and the Mathematics Curriculum

Many states presently have behaviorally stated objectives for pupils to achieve. These objectives are available to teachers prior to instruction. The objectives generally are developed on the state level with the involvement of leading teachers, supervisors, and administrators in the state. Each objective is stated very precisely, generally, with much specificity. At selected intervals during the school year, pupils are tested to determine if the stated objectives have been achieved and to what extent. Numerical data is then available pertaining to each child's progress in mathematics. These tests are called criterion referenced tests (CRTs). The following are objectives that are stated precisely and in measurable terms:

1. The pupil will add correctly nine out of ten addition problems containing two single digit numerals. After instruction the teacher may

measure to ascertain if pupils' individually have achieved the stated objective.

2. The pupils will solve three word problems with 100 per cent accuracy. After instruction, the teacher measures if pupils have achieved the objective. Learning activities provided for pupils to attain the stated objective need to align, not be separated from what is stated in the objective.

The teacher in using CRTs may announce prior to instruction what pupils are to learn. It is only wise for the teacher to prepare pupils for achieving each new objective with readiness experiences. Thus, pupils need to have had adequate learning opportunities prior to the teacher stressing each new objective in mathematics. Pedagogical readiness would indicate that the teacher has quality learning activities listed in the daily lesson plan so that pupils may be successful in achieving objectives. Adequate and good preparation is necessary on the teachers part to motivate pupils to achieve an objective. Unsuccessful learners in achieving an objective might well need a different teaching strategy. Pupils need to be ready in terms of maturation to achieve each objective. Piaget stressed the following levels of pupil maturation on the elementary school levels:

1. Sensorimotor Intelligence- birth to two years. These are the preschool years.

2. Preoperational Intelligence-- ages two through seven. This includes the kindergarten and first grade levels whereby pupils generally perceive one variable at a time only in a mathematical situation.

3. Concrete operations--ages seven through eleven. These age levels include grades two through grade five, in general. Pupils need many concrete objects in teaching as was true at the previous stage, but now may perceive numerous variables at a time in mathematics.

4. Formal operations -- ages eleven and up. This includes pupils in grades six and higher. Here, pupils notice many variables at a time and concrete materials of instruction in mathematics are generally not as necessary as compared to the stage of concrete operations.

Piaget did research on pupils for over fifty years in Switzerland when developing the above four levels of maturation. I suggest studying these levels thoroughly and noticing if the pupils you teach are on these approximate levels of maturation for their age level. Teachers need to be students of research to notice what is recommended in education and what can be done to assist pupils to achieve more optimally. To be sure, there are different levels of readiness for pupils and the teacher may be wasting much time in teaching by attempting to hasten a child being ready to add, subtract, multiply, and divide at different levels of complexity. For example, it would be ridiculous to teach a first grade pupil to divide a seven digit dividend and a three place divisor with

renaming and having a remainder, unless the learner is extremely precocious. With ample readiness and quality sequence, the pupil can be successful and succeed in achieving objectives in mathematics instruction (Ediger, 1988).

Using Teacher Observation

The teacher needs to be a good observer of pupils in contextual situations when pupils are actively engaged in ongoing lessons and units of study. It takes practice and effort to focus on specifics that pupils are learning in mathematics. Also, to be a good observer, the teacher needs to be current and updated in trends in mathematics to know what is being advocated in a modern program of mathematics instruction. What might a teacher be looking for when observing pupils in daily activities in the mathematics curriculum?

1. the quality of attitudes possessed by learners individually toward mathematics. If pupils possess negative attitudes, the teacher needs to be very observant here and assist learners to be successful in each specific step of learning. Failure to learn makes for uncomfortable feelings. No one likes to fail! When I think back of times that were uncomfortable for me in grade school, I readily recall when the teacher spoke down to me as a first grader and said, "Do you know what a pumpkin is?" This was at Halloween time. My feeling was that there was belittling here. I started first grade not knowing English since low German was spoken in the home and community whereas high German was the language of the church. I made rather rapid progress in learning to speak English since I was asked many times by the first grade teacher in the second semester to pronounce words to pupils reading silently who needed assistance with word identification.

A second time belittling occurred when as a junior in high school, I had written an English class essay entitled, "Death on Second floor." This paper was voted by the class of twenty-five members to be the second best essay written. The essays had been posted on the wall for reading by all students in the class. Having grown up in a strong conservative General Conference Mennonite community, the title of the essay sounded rather unusual for me to write about. I talked to the English teacher after class and said that I had not expected to be second highest in class. She replied, "I'm glad that you noticed how poorly your paper had been written." That remark felt like a lead balloon. I learned quickly what not to say as a teacher from this incident. Negative remarks have no place in comments made to pupils about their school work. Rather, there needs to be encouragement and rewarding for what is done well. I doubt very much that hostile remarks made by the teacher will change pupil work from negative to positive.

Pupils need to experience challenge in the mathematics curriculum and yet the expectations are reasonable in that learners can be successful in achieving objectives. For work well done, pupils should be praised for actual accomplishments. What has not been done well by a pupil needs diagnosis and remediation. If a pupil, for example, makes the following error in subtraction: $42-25=27$, the teacher needs to assist the pupil to determine reasons for the wrong answer. The pupil might not have understood the concept of renaming/regrouping or borrowing in subtraction. The pupil might have been careless in subtracting the subtrahend from the minuend. The pupil might not have looked at the numerals carefully to notice the processes involved in arriving at the correct answer. What might the mathematics teacher notice when observing pupils being engaged in learning activities?

2. background information understood by the pupil involving facts, concepts, and generalizations needed in the new lesson. For example, does the pupil understand the addition fact of a set of four objects and a set of five objects combined make a new set of nine objects so that $4+5=9$. Manipulative materials need to be used to make learnings meaningful to pupils.

Pertaining to concepts, does the pupil understand the concept of regrouping and renaming or carrying in addition such as in $36+47=83$? Six plus seven in the ones column requires regrouping in terms of thirteen ones is equal to one ten and three ones as well as three tens plus four tens is equal to seven tens. One ten from the ones column needs to be joined to the seven tens to make for eight tens. Place value is also a very valuable concept for pupils to understand here, such as the ones, tens, hundreds, and thousands columns for whole numbers. Generalizations that pupils may need here involve, "changing the order of addends does not affect the sum." This is also the commutative property of addition whereby this generalization may be used on any level of instruction from kindergarten through graduate study. Thus $4+5=5+4$ or $1,967,453+3,265,923=3,265,923+1,967,453$. By emphasizing the commutative property of addition and multiplication, it cuts down on the number of facts to be learned by 50 per cent.

Thus, if pupils miss the understanding of a generalization, might it be that pupils do not attach meaning to a concept within the generalization? Or if a concept lacks understanding, might it be that the pupil does not attach meaning to selected facts therein? It is then very important to have quality sequence or order in pupils engaged within ongoing learning activities. Adequate background information or readiness for learning in the new lesson or unit of study is very important.

3. the style of learning possessed by the pupil. Questions involving style of learning deal with under what conditions pupils learn

best. The teacher needs to observe the pupil carefully to ascertain which kinds of learning opportunities to provide pupils. Does a learner achieve more optimally with concrete, semiconcrete, and/or abstract materials of instruction? Should pupils have more of individual or cooperative class work in mathematics. It might even be that pupils like to work in dyads, two pupils working together on a task in mathematics. The teacher modeling instruction to the class as a whole may be adequate for selected pupils to go ahead on their own on assignments or self selected learning opportunities. Thus, there are selected methods of instruction that pupils like best in terms of activities and experiences.

4. ways of showing what has been learned. there are numerous approaches whereby pupils individually as well as in groups may reveal what has been achieved. The mathematics teacher needs to be knowledgeable about and informed on how learners might indicate what has been learned. Generally, paper/pencil tests have been used to test pupil learning in any lesson or unit of study. These tests have included standardized, criterion referenced, and teacher written tests. These approaches can be used along with others, such as Howard Gardner's theory of multiple intelligences (Gardner, 1993). Too frequently when testing pupil achievement, linguistic intelligences is used by the learner, such as in reading and writing. There are other intelligences which pupils may use such as logical/mathematical to indicate what has been learned. Here, the world of mathematics may be used to show progress and achievement. The following are additional intelligences as determined by Howard Gardner (1993):

1. space such as is stressed in geometry and in the art curriculum. Many geometrical drawings may be made by pupils to indicate what has been learned.
2. kinesthetic such as in athletic endeavors and dance with body movement in general.
3. objective pursuits such as in science.
4. social interests such as in pursuing learnings of people in time and place.
5. musical intelligence.
6. interpersonal (achieving in group endeavors) and intrapersonal (accomplishing in individual work) intelligences.

Individual differences might well be provided for when using multiple intelligences theory to permit pupils to show in diverse ways what has been learned. Again, the range of experiences in indicating what has been learned needs to be expanded beyond that of verbal intelligence.

Conferences with Pupils

The teacher needs to have conferences with pupils individually as

well as collectively to appraise achievement in mathematics. These conferences may zero in on what pupils liked best about the mathematics curriculum. The questions may become more specific by noticing and discussing the following with pupils:

1. determining why assignments are not completed on time. If the assigned work is not completed as the deadline is there, what causes this to happen?

2. having pupils say what is not understood in a lesson or unit of study.

3. let pupils explain a new process in mathematics being emphasized by revealing how this is to be done.

4. obtaining data from learners as to the kinds of learning activities that are most beneficial.

5. asking pupils which topics they wish to pursue in mathematics.

6. finding out how pupils wish to be appraised in mathematics in addition to or in place of paper/pencil tests.

7. plan with pupils an enrichment center or in depth learning station to extend the mathematics curriculum, beyond that of the daily lesson and unit teaching plan being stressed.

8. ascertain how many pupils would be interested in an after school mathematics club where topics may be studied intensively. The discussion may also center upon developing a mathematics club before school and during the school day.

The teacher needs to consult with pupils on ways to improve achievement in mathematics and involve pupils wherever possible in having higher quality objectives, learning opportunities, and evaluation procedures (Ediger, 1995).

Parent/Teacher Conferences in Mathematics

A very valuable procedure to use in the evaluation of pupil progress in mathematics is to use parent/teacher conferences (Ediger, 1996). Teachers may learn much about pupils by listening to comments made by parents. Generally, parents have the interests of their child in mind when interacting with the mathematics teacher. In these conferences, parents may wish to share information about their child with the teacher so that an improved curriculum is an end result. Parents might also wish to discuss with the teacher what interests the child in mathematics. Further discussions may zero in on what makes for problems by the child in learning mathematics. Politeness is always important in a parent/teacher conference. Careful and caring listening also needs to be stressed. The mathematics teacher wants to learn as much as possible about each pupil so that the best curriculum possible may be in the offing. As an elementary school teacher, the most

successful conference I had with a parent involved discussing the following problems faced by the involved fifth grade pupil:

1. multiplying a two digit by two digit number whereby regrouping and renaming was involved. The parents even gave a specific set of factors in multiplication that the child had experienced difficulty with. When specifics such as these are discussed, the mathematics teacher receives very valuable information on what assistance that child needs in school as well as in the home setting.

2. being distracted from learning by the best friend of the child. The parents requested I change where these two were seated so that disturbing each other was much less likely. This request was easy to comply with.

3. providing enrichment work for the child, beyond that being assigned. A mathematics teacher should certainly be happy to comply here.

4. making certain the child is working on the task at hand in mathematics so that as much is being learned as possible. I replied to the parents that the child tended to work hard, but I would continually observe to see that the pupil learned as much as possible.

It was quite obvious that the above named parents took their roles in life very seriously and wanted their child to achieve as much as possible. The child was doing very well in mathematics achievement and had a good attitude toward mathematics as well as all curriculum areas in school. I have always believed that if all parents would have the interests of the child at hand as did these parents, optimal achievement in mathematics would definitely be possible. It indeed was a joy to have that pupil in the classroom. The role model presented by this learner was an inspiration to many other pupils in class.

Diagnosing Pupil Difficulties in Mathematics

There are commercial diagnostic tests available to notice pupil weaknesses in mathematics. I believe the mathematics teacher can do a better job of diagnosing pupil difficulties as compared to commercial tests. Why? Within a contextual situation, the teacher may notice the kinds of errors pupils make and offer assistance at that moment to remedy the exhibited deficiencies. With commercial tests, the items thereon are outside the framework of what pupils are presently studying in mathematics. When observing pupil problems at a given time in mathematics, what pupils are not doing correctly can be noticed and assistance provided to overcome identified errors. I will describe a few errors on different grade levels which I have observed as a university supervisor of student teachers.

A first grade pupil continually added $5+2=6$. The teacher noticed this error and assisted the pupil to overcome the difficulty by showing five fingers on one hand and two fingers on the second hand. These two sets were then combined to make for a sum of 7. The pupil counted the total number of fingers involved. Once the pupil had reviewed that $5+2=7$, the addition fact was written into her small notebook for reference. There are times, after meaning has been established, to have pupils put into long term memory the sum of an addition fact.

A second grade pupil continually subtracted in the following manner: $8-2=10$; $7-4=11$; and $6-3=9$, among others. The pattern of error here is quite obvious. The pupil was adding instead of subtracting. The pupil was carefully taught to notice the operation sign and to differentiate the minus from the plus sign. To the best of my knowledge, the pupil never made the same error again. The errors exhibited by this pupil may have involved carelessness. Habits of carelessness need to be overcome with assisting the learner to becoming a responsible person.

A third grade pupil completed a set of word problems in which unnecessary information was inherent, such as a family drove three hundred miles each day for five days and spent during that time \$200 for food. How many miles did the family drive? The pupil added the 200 on to the 1,500 miles driven. Here, the teacher assisted the pupil to be a critical thinker and analyze what is asked for in the word problem. The question asked in the problem pertained to how many miles the family drove in five days. Nothing was asked about the amount of money spent on food.

A fourth grade pupil copied numerals incorrectly from the basal textbook and therefore came up with several incorrect answers to word or story problems. The teacher assisted the pupil by having the latter read aloud the story problem, especially to notice the numerals therein. Rereading was necessary in several situations. The pupil had to read the story problems with the numerals accurately until mastery was in evidence. The carryover or transfer values seemingly were noticeable. However, additional assistance in this area at different intervals had to be given.

Selected fifth grade pupils had severe problems in reading and did not comprehend several word problems in mathematics. These pupils, in an atmosphere of respect, were taken aside and given needed help. The word problems were read orally by a good reader to these pupils. A cardinal rule in this classroom was to assist others, but never ridicule or minimize anyone.

Two sixth grade pupils had to be given assistance to work on the task at hand, after an assignment had been made involving the basal mathematics textbook.

The mathematics teacher needs to notice the kinds of errors pupils make specifically and then provide needed guidance. I will briefly outline other kinds of errors I have observed that pupils make.

1. subtracting a smaller value from a larger one even though the numerals there do not call for this such as $520 - 218 = 318$, e.g. 8-0 in the one's column is considered rather than regrouping and renaming from the two tens in the minuend which is necessary when subtracting 218 from 520. The teacher needs to be a good listener when pupils explain the processes following in arriving at an answer.

2. adding two values whereby regrouping and renaming are involved but not being used such as in $36 + 25 = 51$. Here, the pupil added $6 + 5$ to come up with eleven as the sum, but did not carry the one ten from the ones column to the tens column.

3. checking division problems by having memorized that the divisor times the quotient is equal to the dividend without doing the actual multiplying of the divisor times the quotient to see if the work is done correctly and is equal to the dividend. To be sure once the understanding is there of how to check a division problem, the pupil should use a calculator to make the mathematics curriculum more enjoyable and of interest.

4. lacking skills in reading whereby misunderstandings occur in working word problems. Pupils sometimes need assistance in identifying unknown words. Word recognition skills that should be stressed include using context clues, phonics, syllabication, structural analysis, and picture clues. Independence needs to be developed in reading involving mathematics content (Ediger, 1998).

5. not noticing operation signs carefully such as $+$, $-$, $\times$, and their inverse operations.

6. misunderstandings pertaining to the commutative, associative, and closure properties.

7. attempting to memorize without understanding what has been learned, such as the formula for finding the volume of a cylinder, pyramid, and cone.

8. inadequate attention paid to ongoing discussions involving a new process such as dividing fractions which was preceded in sequence by multiplication of fractions.

9. being in a hurry to complete an assignment so that recreational pursuits may be followed. Pupils need to be taught to pay careful attention to what is being pursued and to do the best possible in achievement. If something is not understood, the pupil needs to ask for help.

10. refraining from enjoying and appreciating mathematics. Here, the teacher needs to determine where the learner is presently and then provide sequential experiences in which the pupil may be successful. Learning activities need to capture the interests of learners.

Using Checklists

Many teachers find that using checklists are helpful in remembering what pupils have misunderstood in ongoing lessons and units of study. Behaviors are listed on a paper in which a learner's name may be written in. The following is an example of a checklist:

Name of pupil----- Date-----

1. Understands place value of ones, tens, and hundreds
(encircle which needs more emphasis, if any)
2. Can regroup and rename in addition.
3. Reads numerals accurately.
4. Stays on task.
5. Asks for assistance when needed.
6. Writes legibly.
7. Reads words with meaning and understanding.
8. Has a good attitude toward mathematics.
9. Helps others, as is necessary in mathematics.
10. Listens carefully during discussions.
11. Takes an engaged role in learning opportunities.
12. Solves problems using an effective approach.

In the above checklist, the teacher may place a check mark in front of the behavior that a pupil needs more help in. By dating and keeping a running record of pupil progress, the mathematics teacher is better able to maintain a careful perspective of where a learner is achieving presently in each objective. Growth in the above behaviors should be continuous with each pupil achieving as best possible.

A slight variation of the check list is to use the rating scale. Thus, no one pupil will ever achieve the above behaviors perfectly once and for all, but rather in degrees the pupil will achieve, grow, and develop. For example, in behavior number twelve above, "Solves problems using an effective approach," the pupil will continuously achieve at a more optimal rate and not achieve the objective as an absolute. Ratings may then be given each pupil on a five point basis. A rating of 5 indicates outstanding work for the pupil at his/her present achievement level, whereas a rating of 1 indicates the pupil is very weak in this area. In between ratings of 4, 3, and 2, may be given based on a teacher's observations.

The teacher may save the pupil's checklist results as well as the completed rating scale, for filing, and make comparisons with future

observations. It is easy to forget or become hazy on a pupil's achievement unless records are preserved in a folder for each pupil.

Computer Managed Evaluation

An increased number of teachers and administrators are recording pupil achievement results using computer services. Thus for each pupil, a running record may be kept on pupil's test scores from teacher written tests, results from CRTs and norm referenced tests, observations made on pupil work habits by the teacher, records of conferences with pupils and with parents, diagnostic information, as well as check lists and rating scales. Journal writing by the teacher pertaining to pupil achievement in mathematics may also be entered into the computer. Student teachers and cooperating teachers whom I have supervised in the public schools provide a good testimony as to the effectiveness of looking at a single child's achievement on the monitor with a wide variety of information to guide in making curricular decisions in mathematics for the involved learner. Teachers need to possess much information pertaining to each pupil in order to make better decisions in terms of sequence in learning for any one pupil. Modern technology then has made it so that

1. little effort is put forth by the teacher into storing information in the computer.
2. Information may be quickly recalled for any one learner and analyzed on the monitor.
3. Information retrieved may be used by the teacher to increase and improve sequence in learning for each pupil.
4. diagnosis is possible when using information on the monitor for any one pupil to assist the learner to overcome weaknesses in the mathematics curriculum.
5. objectives for a single pupil or the class as a whole may be secured from an overview of learner progress, as presented on the monitor.
6. learning opportunities may be chosen by the teacher according to needs as revealed by pupils.
7. new procedures may be arrived at to further determine needs of pupils in ongoing lessons and units of study in mathematics.
8. machine scored tests provide teachers opportunities to work with pupils on instructional problems in mathematics, rather than working with the mundane in hand scoring tests.

Portfolios to Appraise Mathematics Achievement

Portfolios have become increasingly popular as a way of

evaluating pupil progress. Portfolios stress the importance of having pupil records preserved in everyday work performed in mathematics. Results from teacher written tests, teacher diagnostic observations, journal writing by the teacher of pupils' achievement, anecdotal records and diary entries kept by the teacher to record specific achievements in ongoing lessons and units of study, purposeful worksheet pages completed by pupils, written work of learners such as book reports on mathematics content, daily assignments completed such as from a basal textbook, and log entries kept on attitudes of pupils toward diverse learning opportunities in mathematics are important in the evaluative program. The emphasis here is upon contextual work of pupils in mathematics. Within context, pupils and the teacher appraise the former's specific progress made on a daily and unit basis. The evaluations are made internally to the experiences of pupils, not externally. External evaluations consist of standardized test and criterion referenced test results. Both of these tests are written by educators removed from the local teaching situation. Standardized and criterion referenced tests are given very infrequently such as each being given once a year. Pupil achievement needs to be evaluated more frequently than that. Evaluation of pupil achievement in mathematics needs to be continuous so that the teacher receives feedback on how well a pupil is achieving in mathematics. Diagnosis stresses noticing the kinds of errors pupils individually make and giving assistance to learners in overcoming these deficiencies. Both pupils and teachers need to be actively involved in appraising individual progress of learners in mathematics. What items of pupil products and processes might go into a portfolio for a pupil?

1. a representative sampling of daily work of pupils in mathematics, such as problem solving activities.
2. snapshots of models made such as model cubes, cylinders, pyramids, and cones in ongoing lessons and units of study.
3. videotapes of committee and collaborative work by pupils in committee settings.
4. pupil self evaluation statements as to goals accomplished and those that remain to be achieved within a given period of time.
5. cassette recordings of discussions and book reports involving the owner of the portfolio.
6. art work as it relates to mathematics, such as geometry art.
7. pupil administered self evaluation containing checklists, rating scales, and journal entries.
8. pupil test results from teacher written tests in mathematics.
9. construction items as it is feasible to store these items due to size and places of storage.
10. uses made of technology such as calculators and computers in the mathematics curriculum.

Portfolios and their use emphasizes a definite philosophy of education such as using internally contextual experiences of pupils to evaluate each learner's progress. Thus, pupils and the teacher are heavily involved in portfolio development. Authentic assessment is then in evidence (Valencia, Hiebert, and Afflerbach 1994)13

Conclusion

A modern mathematics curriculum emphasizes using a variety of evaluation techniques to ascertain pupil achievement. Too frequently in the past, standardized norm referenced tests and their results provided major acceptable information pertaining to pupil achievement. These tests have no accompanying objectives for teachers to use in teaching mathematics. Then too, norm referenced tests spread pupils out from high to low in terms of test results, such as from the 99th to the first percentile. Spreading pupils out from high to low is one of the functions of a norm referenced test. Pupils might then be compared from results of the test as to who the high, middle, and low scorers are. Today, the emphasis is placed upon pupils be evaluated in terms of having achieved stated objectives in mathematics in ongoing lessons and units of study, not making comparisons among learners. A variety of approaches are used to ascertain pupil achievement in mathematics.

These approaches include

1. Criterion referenced tests.
2. Teacher observation of an individual's progress in mathematics.
3. Conferences with pupils.
4. Parent and teacher conferences.
5. Diagnostic testing and their results.
6. Check lists and rating scales.
7. Computer managed evaluation.
8. Portfolio approaches in ascertaining pupil achievement.

References

- Ediger, Marlow (1997), Teaching Mathematics in the Elementary School. Kirksville, Missouri: Simpson Publishing Company, 302-317.
- Ediger, Marlow (1988), The Elementary Curriculum, Second Edition. Kirksville, Missouri: Simpson Publishing Company, 141-148.
- Ediger, Marlow (1995), "Current Concepts in Teaching Mathematics, Philippine Education Quarterly, 7-20.
- Ediger, Marlow (1996), Elementary Education. Kirksville, Missouri: Simpson Publishing Company, 193-208.

Ediger, Marlow (1998), "Listening and Reading in the Elementary School," Experiments in Education, May, 1998.

Gardner, Howard (1993), Multiple Intelligences: Theory Into Practice. New York: Basic Books.

Valencia, Shella W., Elfrieda H. Hiebert, and Peter P. Afflerbach (1994). Authentic Reading Assessment: Practices and Possibilities. Newark, Delaware: International Reading Association.